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(54) **Apparatus for equipment unit protection switching**

Vorrichtung zur Sicherheitsabschaltung einer Versorgungseinheit

Appareil à interrupteur de protection pour un équipement

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Description

Technical Field

This invention relates to equipment unit protection switching and, more particularly, to minimizing disruption of customer service during equipment unit protection switching.

Background of the Invention

It has been the practice to employ redundant equipment units, e.g., plug-ins, circuit packs and the like, to enhance product reliability. The enhanced reliability has been realized by controllably switching service to a standby equipment unit upon detection of a failure of an in-service equipment unit or its removal from a connector in an equipment frame.

Prior known equipment unit protection switching arrangements that were specifically directed toward removal of equipment units, relied upon the complete disengagement of the equipment unit from its connector before initializing equipment unit protection switching. Any movement of an equipment unit in its connector tends to cause transmission errors which have the potential for affecting customer service. This is especially true in relatively high digital bit rate transmission arrangements.

In such prior equipment unit protection switching arrangements, the time required to effect equipment unit protection switching is directly dependent upon the speed at which the equipment unit is being removed from its connector. If the equipment unit was removed quickly, the protection switch would occur sooner than if it was removed slowly. In any event, the interval is still too long before completion of the equipment unit protection switching. Prior attempts at minimizing the time required to complete equipment unit protection switching were primarily directed toward the use of complex fault detection and isolation algorithms. Such prior algorithms required a significant amount of processing time and processing resources.

US-A-4071722 and EP-A-0254456 are substantially as described in the preamble of claim 1.

According to the present invention, there is provided apparatus as defined in claim 1.

These and other problems and limitations of prior known equipment unit protection switching arrangements are overcome, in accordance with the invention, by controllably anticipating the removal of an in-service equipment unit from its connector to initiate equipment unit protection switching prior to any movement of the equipment unit in its connector.

In one embodiment of the invention, an equipment unit latch and associated light responsive switch arrangement is advantageously employed to provide an indication that the in-service equipment unit is about to be removed from its connector. Once the latch is moved

in initiating removal of the equipment unit, the associated light responsive switch provides an equipment unit removal indication signal which is employed to initiate equipment unit protection switching from the in-service equipment unit to the redundant standby equipment unit. Operation of the equipment unit protection switching algorithm is such that the protection switching is made to the redundant standby equipment unit before any movement of the in-service equipment unit has occurred toward disengaging it from its connector.

In a specific embodiment of the invention, a light sensor switching arrangement including an infrared emitter and associated detector, is employed as the associated light responsive switch.

A technical advantage of this invention is that an equipment unit protection switching is completed from the in-service equipment unit to the redundant equipment unit before any movement has occurred of the equipment unit being removed and consequently, only out-of-service equipment units are actually removable.

Brief Description of the Drawing

In the drawing:

FIG. 1 is a cut-away cross section view of an equipment unit inserted into an equipment frame;

FIG. 2 is another cut-away cross section view of an equipment unit about to be removed from an equipment frame;

FIG. 3 shows, in simplified form, a portion of a face plate latch and a circuit diagram of the associated switch arrangement;

FIG. 4 depicts, in simplified form, a system arrangement employing the invention;

FIG. 5 is a flow chart illustrating steps taken utilizing the invention; and

FIG. 6 graphically illustrates the time intervals at which the steps of FIG. 5 are effected.

Detailed Description

FIG. 1 shows a cut-away cross-section view of an equipment unit employing an equipment unit latch and an associated switch arrangement which may advantageously be employed in the invention. Shown is equipment unit 100 which, in this example, includes circuit board 101, face plate 102, latch 103, locking clip 104, alignment block 105, light emitter 106 and light detector 107. Additionally, circuit board 101 includes one end and a plurality of contacts (not shown) adapted to be inserted into a corresponding connector (not shown) supported by the equipment frame. Latch 103 is pivotally mounted to circuit board 101 at a pivot point via, for example, shoulder rivet 108. The portion of the equipment frame shown comprises upper shelf 109 including U-channel 110. Locking clip 104 is attached to alignment block 105 which, in turn, is mounted on circuit board 101. Locking

clip 104 and alignment block 105 are arranged such as to affix latch 103 in place, i.e., in a closed position, when equipment unit 100 is fully inserted in the equipment frame. This is important to prevent inadvertent operation of the invention in generating an equipment unit removal indication signal. Such inadvertent operation of the invention could possibly be caused by vibration and the like.

Latch 103 includes a first lever arm 111 for application of rotational force which is typically applied by a person's hand or finger. A second lever arm 112 is shown as being hook shaped and includes so-called "cam-in" surface 114 and so-called "cam-out" surface 115. Cam-in surface 114 engages the rear surface of U-channel 110 when equipment unit 100 is being inserted into the equipment frame and cam-out surface 115 engages the front surface of U-channel 110 when equipment unit 100 is being extracted from the equipment frame. FIG. 1 shows the relative position of cam-in surface 114 and cam-out surface 115 when equipment unit 100 is fully inserted into the equipment frame. The spatial placement of U-channel 110 in shelf 109 and the dimensional spacing between surfaces 114 and 115 are important to the operation of latch 103 with the associated switch arrangement including light emitter 106 and light detector 107, in order to controllably anticipate the removal of an in-service equipment unit 100, in accordance with the invention.

Latch 103 also includes so-called latch rib 116 that is physically dimensioned and is arranged, in this example, such that light emitted from emitter 106 is blocked, i.e., inhibited, from being detected by detector 107 when equipment unit 100 is fully inserted in the equipment frame. That is, when latch 103 is in a closed position. It is important to note that detector 107 must be placed in such a position so that spurious light or light other than from emitter 106 cannot be detected. Detection of such spurious light could cause generation of an inadvertent erroneous equipment removal indication signal and is extremely undesirable. In this embodiment of the invention, an infrared emitter and detector arrangement are advantageously employed for emitter 106 and detector 107, respectively. Again, the dimensions of U-channel 110, latch arm 112, cam-in surface 114, cam-out surface 115 and latch rib 116 are such that generation of an equipment unit removal indication signal is inhibited when equipment unit 100 is fully inserted in the equipment frame. Note that the space between the inner surface of cam-out surface 114 and the front surface of U-channel 110 is such as to allow appropriate movement by lever arm 112 and, hence, latch rib 116 in order to allow light from emitter 106 to be detected by detector 107 prior to any movement of equipment unit 100 in the equipment frame, in accordance with an aspect of the invention.

FIG. 2 depicts a cut-away view of a portion of equipment unit 100 about to be removed from the equipment frame. Again, elements identical to those described

above in relation to FIG. 1 are similarly numbered and are not described again in detail. FIG. 2 clearly illustrates that the dimensions of and placement of U-channel 110 in shelf 109 of the equipment frame and the dimensions of lever arm 112, including cam-in surface 114 and cam-out surface 115, are such as to allow sufficient movement of lever arm 111 and, hence, latch rib 116, in order to generate, in accordance with an aspect of the invention, an equipment unit removal indication signal prior to movement of equipment unit 100 in the equipment frame. In this example, the equipment unit removal indication signal is generated by detector 107 detecting light 201 emitted from emitter 106. Referring again to FIG. 1, the distance between the inner surface of cam-out surface 115 and the adjacent front surface of U-channel 110 is such as to allow the appropriate movement of latch lever arm 111 and, hence, latch rib 116, so that the equipment unit removal indication signal is generated prior to any movement of equipment unit 100 in the equipment frame.

FIG. 3 shows, in simplified form, details of a portion of the latch lever arm and a circuit diagram of the associated switch arrangement employed in this example to generate the equipment unit removal indication signal for effecting equipment unit protection switching in accordance with the invention. Specifically, shown are a portion of latch lever arm 111 including latch rib 116, light emitter 106 and light detector 107. Light emitter 106 is connected, in this example, when equipment unit 100 is fully inserted into the equipment frame and its connector, to a power source in such a manner as to emit light (infrared) continuously, in well known fashion. Detector 107 is also connected to a source of potential via resistor 301 and to a reference potential, e.g., ground potential. Thus, detector 107 is arranged so that when it detects light from emitter 106, a potential transition step, i.e., the equipment unit removal indication signal is supplied as an output via buffer amplifier 302. Hysteresis is employed in the transfer function of buffer amplifier 302 to prevent so-called decision chatter when latch rib 116 moves through the cross-over point of detector 107. The equipment unit removal indication signal is supplied, for example, to a controller or the like to effect the desired equipment unit protection switching action. As indicated above the equipment unit removal indication signal, is generated when latch lever arm 103 and, hence, latch rib 116 is initially moved a sufficient distance to enable the light to pass from emitter 106 to detector 107, in accordance with an aspect of the invention. As described below, the controller is responsive to the equipment unit removal indication signal to effect an appropriate protection switching algorithm for switching signals being transmitted from the requesting active, i.e., in-service, equipment unit to its associated standby equipment unit, in accordance with the invention.

FIG. 4 shows, in simplified block form, an arrangement employing an embodiment of the invention. Shown are controller 401, active equipment units 402-A, 403-A

and 404-A and corresponding standby equipment units 402-S, 403-S and 404-S. It is desirable to switch from an active, i.e., in-service, equipment unit to a standby equipment unit prior to removal of the active equipment unit and, by employing the invention, prior to any movement of the active equipment unit in an equipment frame. This is realized in the system of FIG. 4, in accordance with the invention, by each of equipment units 402-A, 403-A, 404-A, 402-S, 403-S and 404-S, including a latch and an associated light-responsive switch arrangement. Upon any movement of the latch toward an attempted removal of the equipment unit the associated switch arrangement advantageously generates an equipment unit removal indication signal prior to any movement of the equipment unit from a corresponding equipment frame and, more particularly, from a connector therein. The equipment unit removal indication signal is supplied from each of equipment units 402-A, 403-A, 404-A, 402-S, 403-S and 404-S, via circuit paths 405 through 410, respectively, as appropriate to controller 401. In turn, controller 401 is connected via bus 411 to each of equipment units 402-A, 403-A, 404-A, 402-S, 403-S and 404-S. Bus 411 supplies signals to and receives signals from each of the equipment units indicating whether a switching is to be made and/or whether it is an active or a standby equipment unit. It should be noted that upon effecting equipment unit protection switching the appropriate standby unit is the "active" unit and the previously active unit is in a standby or out-of-service mode. Thus, upon receiving an equipment unit removal indication signal from an active equipment unit controller 401 initiates an equipment protection switching algorithm which causes switching of the transmission of signals from the requesting in-service equipment unit to its corresponding standby equipment unit. For example, if active equipment unit 403-A supplies an equipment unit removal indication signal to controller 401, controller 401 would cause the signals being supplied to equipment unit 402-A and to equipment unit 404-A to be selected from equipment unit 403-S rather than equipment unit 403-A. The signals from equipment unit 403-A would appropriately be inhibited at equipment unit 402-A and equipment unit 404-A.

FIG. 5 is a flow chart showing steps in the operation of the invention. Specifically, step 500 indicates a need to remove an equipment unit. This removal is initiated by lifting the latch as indicated in step 501. Step 502 indicates that the associated light responsive switch arrangement, in this example including light emitter 106 and light detector 107, generates the equipment unit removal indication signal. In response to reception of the equipment unit removal indication signal, the controller anticipates the removal of the corresponding equipment unit and forces equipment unit protection switching to the appropriate standby equipment unit, as indicated in step 503. Step 504 indicates that the protection switching has been completed, usually in a relatively short interval. In this example, an equipment protection switch-

ing is typically effected in about five (5) msec. Step 505 indicates that the requesting equipment unit is now inactive. Step 506 indicates that the requesting equipment unit now first begins to move in the equipment frame and, hence, in any corresponding connector that it is inserted in. Step 507 indicates complete removal of the requesting equipment unit from the equipment frame. Step 508 then indicates that the physical removal of the equipment was not service-affecting and there were no transmission errors during the removal.

FIG. 6 depicts a timing diagram illustrating the approximate time intervals at which the steps of FIG. 5 occur. Specifically, the initial movement of the latch occurs at time zero (0). The equipment unit removal indication signal is supplied to the controller at about the 50 msec point and an equipment unit protection switching is typically effected at about the 55 msec point. The previously in-service equipment unit requesting the switching is now also inactive. From this point on (time after about 55 msec), the controller considers that the requesting equipment unit has been removed and ignores any associated fault indications caused by the physical removal. Normally, the now inactive service unit begins to move in its connector at about the 150 msec point. The requesting equipment unit is electrically disengaged from its connector at about the 400 msec point. Thus, in this manner equipment protection switching is made from a in-service active unit to an out-of-service standby unit without transmission errors possibly caused by movement of the in-service equipment unit is its connector. Again, this is realized by advantageously employing the invention to effect equipment unit protection switching prior to any movement of the requesting equipment unit in the equipment frame and, hence, in its corresponding connector.

The above described arrangements are, of course, merely illustrative of the application of the principles of the invention. Although a central controller is employed in the disclosed embodiment, it will be apparent that individual controllers in the equipment units could be equally employed. Moreover, it will be apparent that other positions of light sensor arrangements may be employed. For example, an integral light emitter-detector arrangement could be used in which light from the emitter is normally reflected off a surface either on the latch assembly or the circuit board and supplied to the detector. Then, an equipment unit removal indication signal would be generated by movement of the latch assembly causing the light from the emitter not to be supplied to the detector.

It will also be apparent that the switch arrangements could be placed at other locations on the circuit board or equipment frame to realize the generation of the desired equipment unit removal indication signal. Again, it is important to note in this additional example, the generation of the equipment unit removal indication signal must occur at an appropriate instant after movement of the latch assembly, but prior to any movement of the

equipment unit in the equipment frame, in accordance with an aspect of the invention.

Claims

1. Apparatus for use in effecting equipment unit (402A, 403A or 404A) protection switching from an equipment unit (100) being removed from an equipment frame in which it is inserted to a standby equipment unit (402S, 403S or 404S), the apparatus including an equipment unit (100), said equipment unit (100) including a circuit board (101) inserted in a connector in the equipment frame and a latch (103) pivotally mounted on said circuit board (101) at a pivot point (108) for securing the equipment unit in the equipment frame,

the apparatus further being CHARACTERIZED BY,

said latch (103) having a first lever arm (111) and a second lever arm (112), the first lever arm (111) extending from the pivot point (108) in a first direction and the second lever arm (112) extending from the pivot point in a second direction, the first lever arm (111) being used for application of a first force for causing rotational movement of the latch about the pivot point (108), the second lever arm (112) having a cam out surface (115) for applying a second force toward removal of the circuit board (101) from the connector in the equipment frame when the circuit board (101) is fully inserted in the connector and when the first force is applied to the first lever arm (111) in a direction toward removing the circuit board from the connector, the cam out surface (115) being arranged such as to allow initial movement of the first lever arm (111) from a closed position prior to applying a second force toward removing the circuit board from the equipment frame so that the first lever arm (111) of the latch (103) is allowed to move freely prior to the cam out surface applying the second force (on 110) toward removing the circuit board (101) from the connector in the equipment frame,

a light responsive switch (106, 107) associated with said latch (103) and being responsive to said initial movement of said latch (103) for generating an equipment unit removal indication signal for initiating the equipment unit protection switching prior to any movement of said circuit board (101) in its connector, and a controller (401) responsive to said equipment unit removal indication signal for effecting the protection switching.

2. Apparatus as defined in claim 1 wherein said latch

(103) is positioned to disable said light responsive switch (106, 107) from generating said equipment unit removal indication signal when the equipment unit is fully inserted in the equipment frame and said latch (103) is in a closed position.

3. Apparatus as defined in claim 2 wherein said light responsive switch includes a light emitter (106) and a light detector (107).

4. Apparatus as defined in claim 3 wherein said light emitter (106) comprises an infrared light emitter and said light detector (107) comprises an infrared light detector.

5. Apparatus as defined in claim 3 wherein said light responsive switch further includes an amplifier (302) in circuit with said light detector (107) for supplying said equipment unit removal indication signal as an output, said amplifier having a transfer function employing hysteresis.

6. Apparatus as defined in claim 2 wherein said first lever arm (111) includes a protruding member (116) which inhibits generation of said removal indication signal the when the latch (103) is in the closed position.

7. Apparatus as defined in claim 6 wherein said light responsive switch includes a light emitter (106) and a light detector (107).

8. Apparatus as defined in claim 7 wherein said light responsive switch (106, 107) further includes an amplifier (302) in circuit with said light detector (107) for supplying said equipment unit removal indication signal as an output, said amplifier having a transfer function including hysteresis.

9. Apparatus as defined in claim 7 wherein said light emitter (106) comprises an infrared light emitter and said light detector (107) comprises an infrared light detector.

10. Apparatus as defined in claim 7 wherein said light emitter (106) and said light detector (107) are mounted on the circuit board (101) in prescribed spatial alignment relationship to each other and to said first lever arm (111) of said latch (103) and wherein said protruding member (116) of said first lever arm (111) of said latch (103) is positioned to inhibit light being emitted from said light emitter (106) from reaching said light detector (107) when the equipment unit is fully inserted in the equipment frame and the latch (103) is in a closed position and such that said light detector (107) is able to detect light from said light emitter (106) upon the first lever arm (111) of said latch moving a prescribed distance

upon initiation of removal of the equipment unit (100) from the equipment frame, but prior to any movement of the equipment unit (100) in the equipment frame.

11. Apparatus as defined in claim 9 wherein said protruding member (116) of said first lever arm (111) comprises a protruding element (116) having prescribed dimensions and being such as to be positioned between said light emitter (106) and said light detector (107) when said latch (103) is in a closed position to inhibit light emitted by said light emitter (106) from reaching said light detector (107) when the equipment unit (100) is fully inserted in the equipment frame and the latch (103) is in a closed position and such that said light detector (107) is enabled to detect light from said light emitter (106) upon the protruding element (116) of the first lever arm (111) of said latch (103) moving a prescribed distance upon initiation of removal of the equipment unit (100) from the equipment frame, but prior to any movement of the equipment unit in the equipment frame.

Patentansprüche

1. Vorrichtung zur Verwendung beim Bewirken der Schutzumschaltung einer Geräteeinheit (402A, 403A oder 404A) von einer Geräteeinheit (100), die aus einem Gerätegestell, in das sie eingesetzt werden soll, zu einer Ersatzgeräteeinheit (402S, 403S oder 404S) entfernt wird, wobei die Vorrichtung eine Geräteeinheit (100) enthält, wobei die Geräteeinheit (100) eine Leiterplatte (101) enthält, die in einen Verbinder im Gerätegestell eingesetzt werden soll, -und eine Klinke (103), die zum Sichern der Geräteeinheit im Gerätegestell an einem Drehpunkt (108) an der Leiterplatte (101) drehbar befestigt ist, wobei die Vorrichtung weiter dadurch gekennzeichnet ist, daß

die Klinke (103) einen ersten Hebelarm (111) und einen zweiten Hebelarm (112) aufweist, wobei sich der erste Hebelarm (111) von dem Drehpunkt aus in einer ersten Richtung erstreckt und der zweite Hebelarm (112) sich vom Drehpunkt aus in einer zweiten Richtung erstreckt, wobei der erste Hebelarm (111) zum Aufbringen einer ersten Kraft zum Herbeiführen einer Drehbewegung der Klinke um den Drehpunkt (108) verwendet wird, wobei der zweite Hebelarm (112) eine nach außen gewölbte Fläche (115) aufweist, die eine zweite Kraft zum Entfernen der Leiterplatte (101) aus dem Verbinder im Gerätegestell aufbringt, wenn die Leiterplatte (101) im Verbinder vollständig eingesetzt ist und wenn die erste Kraft

auf den ersten Hebelarm (111) in einer Richtung zum Entfernen der Leiterplatte vom Verbinder aufgebracht wird, wobei die nach außen gewölbte Fläche (115) so angeordnet ist, daß sie eine anfängliche Bewegung des ersten Hebelarms (111) aus einer geschlossenen Stellung vor dem Aufbringen einer zweiten Kraft zum Entfernen der Leiterplatte aus dem Gerätegestell gestattet, so daß sich der erste Hebelarm (111) der Klinke (103) frei bewegen kann, bevor die nach außen gewölbte Fläche die zweite Kraft (auf 110) zum Entfernen der Leiterplatte (101) vom Verbinder im Gerätegestell aufbringt,

ein auf Licht reagierender Schalter (106, 107) der Klinke (103) zugeordnet ist und auf die anfängliche Bewegung der Klinke (103) reagiert, um ein Geräteeinheitsentfernungsanzeigesignal zu erzeugen, um die Schutzumschaltung der Geräteeinheit vor irgendeiner Bewegung der Leiterplatte (101) in ihrem Verbinder einzuleiten, und eine Vorrichtung (401) auf das Geräteeinheitsentfernungsanzeigesignal reagiert, um die Schutzumschaltung zu bewirken.

2. Vorrichtung nach Anspruch 1, bei der die Klinke (103) so positioniert ist, daß sie (über 116) den auf Licht reagierenden Schalter (106, 107) sperrt, das Geräteeinheitsentfernungsanzeigesignal zu erzeugen, wenn die Geräteeinheit im Gerätegestell vollständig eingesetzt ist und die Klinke (103) sich in einer geschlossenen Stellung befindet.
3. Vorrichtung nach Anspruch 2, bei der der auf Licht reagierende Schalter einen Lichtgeber (106) und einen Lichtdetektor (107) enthält.
4. Vorrichtung nach Anspruch 3, bei der der Lichtgeber (106) einen Infrarotlichtgeber umfaßt und der Lichtdetektor (107) einen Infrarotlichtdetektor umfaßt.
5. Vorrichtung nach Anspruch 3, bei der der auf Licht reagierende Schalter weiterhin im Stromkreis mit dem Lichtdetektor (107) einen Verstärker (302) enthält, um das Geräteeinheitsentfernungsanzeigesignal als Ausgangssignal bereitzustellen, wobei der Verstärker eine Übertragungsfunktion mit Hysterese aufweist.
6. Vorrichtung nach Anspruch 2, bei der der erste Hebelarm (111) ein vorstehendes Glied (116) enthält, das die Erzeugung des Entfernungsanzeigesignals sperrt, wenn sich die Klinke (103) in der geschlossenen Stellung befindet.
7. Vorrichtung nach Anspruch 6, bei der der auf Licht

reagierende Schalter einen Lichtgeber (106) und einen Lichtdetektor (107) enthält.

8. Vorrichtung nach Anspruch 7, bei der der auf Licht reagierende Schalter weiterhin im Stromkreis mit dem Lichtdetektor (107) einen Verstärker (302) enthält, um das Geräteeinheitensentfernungssignal als Ausgangssignal bereitzustellen, wobei der Verstärker eine Übertragungsfunktion mit Hysterese aufweist.
9. Vorrichtung nach Anspruch 7, bei der der Lichtgeber (106) einen Infrarotlichtgeber umfaßt und der Lichtdetektor (107) einen Infrarotlichtdetektor umfaßt.
10. Vorrichtung nach Anspruch 7, bei der der Lichtgeber (106) und der Lichtdetektor (107) auf der Leiterplatte (101) in einer vorgeschriebenen räumlichen Ausrichtungsbeziehung zueinander und zu dem ersten Hebelarm (111) der Klinke (103) befestigt sind und wobei das vorstehende Glied (116) des ersten Hebelarms (111) der Klinke (103) so positioniert ist, daß es vom Lichtgeber (106) abgegebenes Licht daran hindert, den Lichtdetektor (107) zu erreichen, wenn die Geräteeinheit im Gerätegestell vollständig eingesetzt ist und sich die Klinke (103) in einer geschlossenen Stellung befindet, und so, daß beim Bewegen des ersten Hebelarms (111) der Klinke um einen vorgeschriebenen Weg nach Einleitung der Entfernung der Geräteeinheit (100) aus dem Gerätegestell, jedoch vor irgendeiner Bewegung der Geräteeinheit (100) im Gerätegestell, der Lichtdetektor (107) Licht von dem Lichtgeber (106) erfassen kann.
11. Vorrichtung nach Anspruch 9, bei der das vorstehende Glied (116) des ersten Hebelarms (111) ein vorstehendes Element (116) umfaßt, das vorgeschriebene Abmessungen aufweist und derart ist, daß es zwischen dem Lichtgeber (106) und dem Lichtdetektor (107) positioniert wird, wenn sich die Klinke (103) in einer geschlossenen Stellung befindet, um vom Lichtgeber (106) abgegebenes Licht daran zu hindern, den Lichtdetektor (107) zu erreichen, wenn die Geräteeinheit (100) im Gerätegestell vollständig eingesetzt ist und sich die Klinke (103) in einer geschlossenen Stellung befindet, und so, daß beim Bewegen des vorstehenden Elements (116) des ersten Hebelarms (111) der Klinke (103) um einen vorgeschriebenen Weg nach Einleitung der Entfernung der Geräteeinheit (100) aus dem Gerätegestell, jedoch vor irgendeiner Bewegung der Geräteeinheit im Gerätegestell, der Lichtdetektor (107) in der Lage ist, Licht von dem Lichtgeber (106) zu erfassen.

Revendications

1. Appareil à utiliser pour effectuer une commutation de protection d'unité d'équipement (402A, 403A ou 404A), d'une unité d'équipement (100) en cours d'enlèvement d'un châssis d'équipement dans lequel elle est insérée, à une unité d'équipement de secours (402S, 403S ou 404S), l'appareil comprenant une unité d'équipement (100), ladite unité d'équipement (100) comprenant une carte imprimée (101) insérée dans un connecteur dans le châssis d'équipement et un loquet (103) monté à pivotement sur ladite carte imprimée (101) au niveau d'un pivot (108) afin de fixer l'unité d'équipement dans le châssis d'équipement,

l'appareil étant en outre caractérisé en ce que ledit loquet (103) comporte un premier bras de levier (111) et un second bras de levier (112), le premier bras de levier (111) s'étendant depuis le pivot (108) dans une première direction et le second bras de levier (112) s'étendant depuis le pivot dans une seconde direction, le premier bras de levier (111) étant utilisé pour l'application d'une première force destinée à provoquer le mouvement de pivotement du loquet autour du pivot (108), le second bras de levier (112) présentant une surface de came d'extraction (115) afin d'appliquer une seconde force en vue de l'enlèvement de la carte imprimée (101) du connecteur dans le châssis d'équipement lorsque la carte imprimée (101) est insérée à fond dans le connecteur et lorsque la première force est appliquée au premier bras de levier (111) dans une direction en vue de l'enlèvement de la carte imprimée du connecteur, la surface de came d'extraction (115) étant agencée de manière à permettre le déplacement initial du premier bras de levier (111) à partir d'une position fermée avant d'appliquer une seconde force en vue de l'enlèvement de la carte imprimée du châssis d'équipement de sorte que le premier bras de levier (111) du loquet (103) peut se déplacer librement avant que la surface de came d'extraction n'applique la seconde force (en 110) en vue de l'enlèvement de la carte imprimée (101) du connecteur dans le châssis d'équipement,

un commutateur photosensible (106, 107) associé audit loquet (103) et réagissant audit déplacement initial dudit loquet (103) afin de produire un signal d'indication d'enlèvement d'unité d'équipement pour amorcer la commutation de protection de l'unité d'équipement avant un déplacement quelconque de ladite carte imprimée (101) dans son connecteur, et un appareil (401) réagissant audit signal d'indication d'enlèvement d'unité d'équipement afin

d'effectuer la commutation de protection.

2. Appareil selon la revendication 1, dans lequel ledit loquet (103) est positionné de manière à empêcher (via 116) ledit commutateur photosensible (106, 107) de produire ledit signal d'indication d'enlèvement d'unité d'équipement lorsque l'unité d'équipement est insérée à fond dans le châssis d'équipement et que ledit loquet (103) est dans une position fermée. 5
3. Appareil selon la revendication 2, dans lequel ledit commutateur photosensible comprend un émetteur de lumière (106) et un détecteur de lumière (107). 10
4. Appareil selon la revendication 3, dans lequel ledit émetteur de lumière (106) comprend un émetteur de lumière infrarouge et ledit détecteur de lumière (107) comprend un détecteur de lumière infrarouge. 15
5. Appareil selon la revendication 3, dans lequel ledit commutateur photosensible comprend en outre un amplificateur (302) en circuit avec ledit détecteur de lumière (107) afin de fournir ledit signal d'indication d'enlèvement d'unité d'équipement en tant que sortie, ledit amplificateur présentant une fonction de transfert utilisant de l'hystérésis. 20
6. Appareil selon la revendication 2, dans lequel ledit premier bras de levier (111) comprend un élément protubérant (116) qui empêche la production dudit signal d'indication d'enlèvement lorsque ledit loquet (103) est dans la position fermée. 25
7. Appareil selon la revendication 6, dans lequel ledit commutateur photosensible comprend un émetteur de lumière (106) et un détecteur de lumière (107). 30
8. Appareil selon la revendication 7, dans lequel ledit commutateur photosensible comprend en outre un amplificateur (302) en circuit avec ledit détecteur de lumière (107) afin de fournir ledit signal d'indication d'enlèvement d'unité d'équipement en tant que sortie, ledit amplificateur présentant une fonction de transfert comprenant de l'hystérésis. 35
9. Appareil selon la revendication 7, dans lequel ledit émetteur de lumière (106) comprend un émetteur de lumière infrarouge et ledit détecteur de lumière (107) comprend un détecteur de lumière infrarouge. 40
10. Appareil selon la revendication 7, dans lequel ledit émetteur de lumière (106) et ledit détecteur de lumière (107) sont montés sur la carte imprimée (101) selon une relation d'alignement spatial prescrite l'un par rapport à l'autre et par rapport audit premier bras de levier (111) dudit loquet (103) et dans lequel ledit élément protubérant (116) dudit premier bras 45

de levier (111) dudit loquet (103) est positionné de manière à empêcher la lumière émise par ledit émetteur de lumière (106) d'atteindre ledit détecteur de lumière (107) lorsque l'unité d'équipement est insérée à fond dans le châssis d'équipement et que le loquet (103) est dans une position fermée et de telle sorte que ledit détecteur de lumière (107) soit à même de détecter la lumière provenant dudit émetteur de lumière (106) lorsque le premier bras de levier (111) dudit loquet se déplace d'une distance prescrite après amorçage de l'enlèvement de l'unité d'équipement (100) du châssis d'équipement, mais avant un déplacement quelconque de l'unité d'équipement (100) dans le châssis d'équipement. 50

11. Appareil selon la revendication 9, dans lequel ledit élément protubérant (116) dudit premier bras de levier (111) comprend un élément protubérant (116) présentant des dimensions prescrites et agencé de façon qu'il soit positionné entre ledit émetteur de lumière (106) et ledit détecteur de lumière (107) lorsque ledit loquet (103) est dans une position fermée pour empêcher la lumière émise par ledit émetteur de lumière (106) d'atteindre ledit détecteur de lumière (107) lorsque l'unité d'équipement (100) est insérée à fond dans le châssis d'équipement et que le loquet (103) est dans une position fermée et de telle sorte que ledit détecteur de lumière (107) soit à même de détecter la lumière provenant dudit émetteur de lumière (106) lorsque l'élément protubérant (116) du premier bras de levier (111) dudit loquet (103) se déplace d'une distance prescrite après amorçage de l'enlèvement de l'unité d'équipement (100) du châssis d'équipement, mais avant un déplacement quelconque de l'unité d'équipement dans le châssis d'équipement. 55

FIG. 1

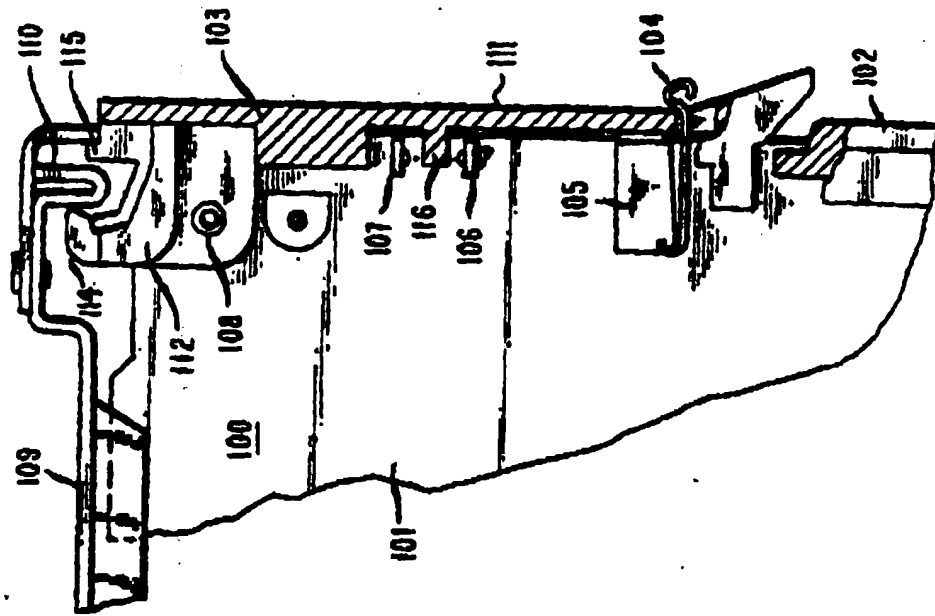


FIG. 2

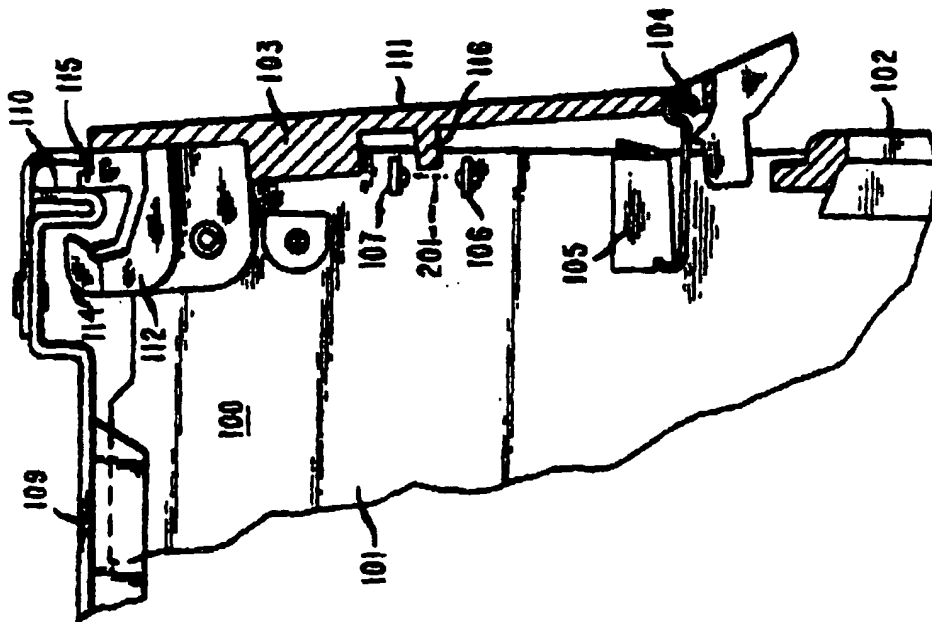


FIG. 3

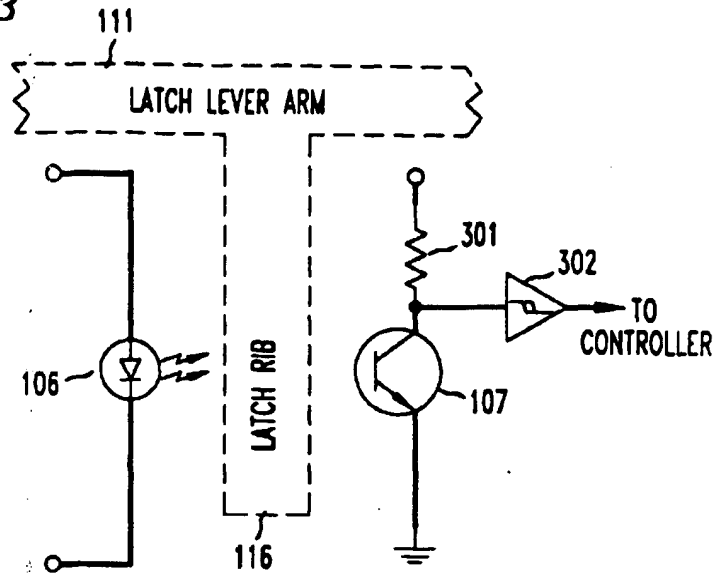


FIG. 4

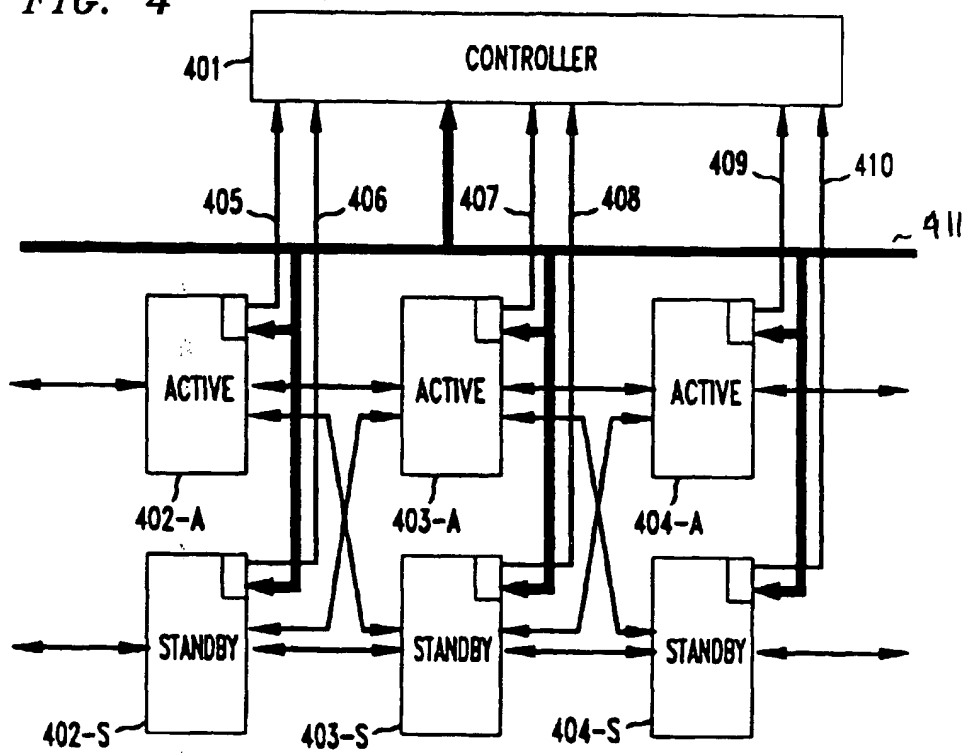


FIG. 5

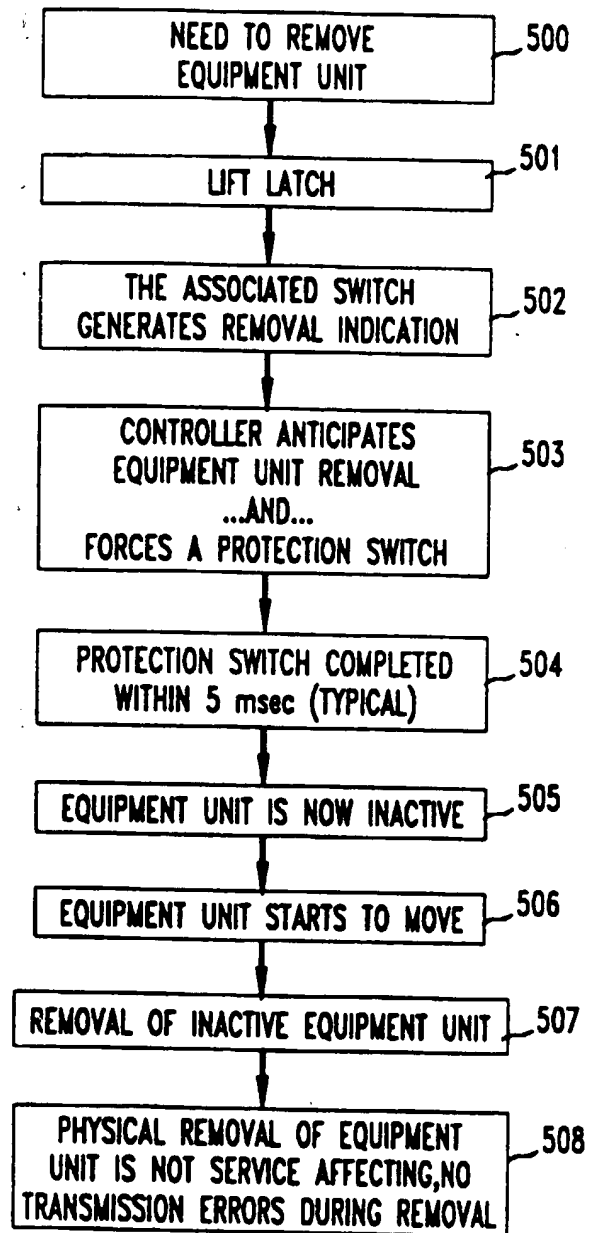


FIG. 6

